TL Series
Total Lead-free Thick Film Chip Resistors
Version. C

FEATURE

- RoHS and Halogen-free compliance
- High reliability and stability.
- Compatible with reflow and wave soldering type
- Applications:
  - Communication devices
  - Computer, notebook, workstation, tablet.
  - etc.

MANUFACTURER PART NO.

For example: TL1206J100KT5G00-TL1206 ±5% 100KΩ T/R-5000

Series	Size	Tol.	Nominal Resistance Value	PKG	SPQ	Feature	TCR
2 codes	4 codes	1 code	2~5 codes	1 code	1 code	1 code	2 codes
TL	1206	F	100K	T	5	G	00
Total Lead-free Thick Film Chip Resistors	0201 0402 0603 0805 1206 1210 2010 2512	D=±0.5% F=±1% J=±5%	1R①=1Ω 4R7=4.7Ω 4K7②=4.7KΩ 100K=100KΩ 4M7③=4.7MΩ 22M=22MΩ	T=T/R④	4=4K 5=5K A=10K B=15K	G=Std. S=P.C.⑤	00=Refer to table as below.

Note: ① R=Radix, 10^0, Ω ② K=Kilo, 10^3, KΩ ③ M=Mega, 10^6, MΩ

④ T/R=Taping in Reel Package. ⑤ P.C.=Personal and Customized.

CHARACTERISTICS

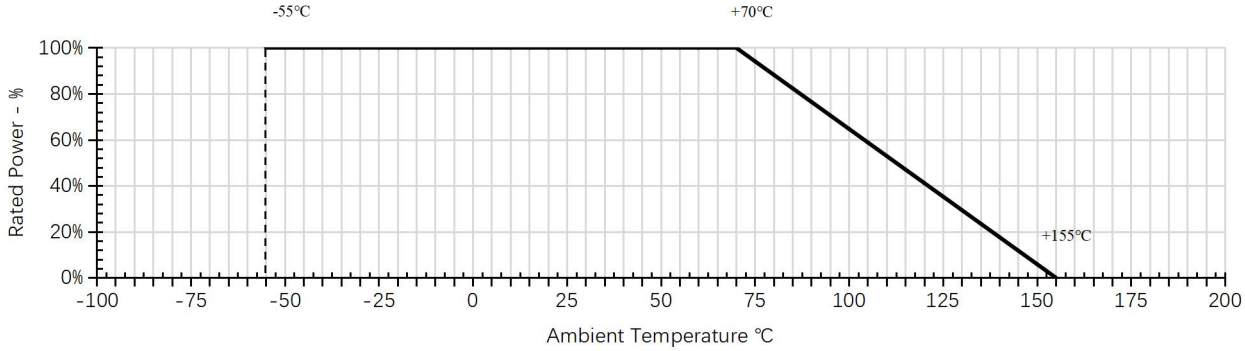
Series	Rated Power	MWV①	MOV②	DWV③	Jumper MRC④	Jumper MOC⑤	Resistance Value Range		
							±0.5%	±1%, ±5%	Jumper
TL0201	1/20W	25V	50V	-	0.5A	1A	-	1Ω-10MΩ	< 50mΩ
TL0402	1/16W	50V	100V	100V	1A	2A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ
TL0603	1/10W	75V	150V	300V	1A	2A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ
TL0805	1/8W	150V	300V	500V	2A	5A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ
TL1206	1/4W	200V	400V	500V	2A	10A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ
TL1210	1/2W	200V	500V	500V	2A	10A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ
TL2010	3/4W	200V	500V	500V	2A	10A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ
TL2512	1W	200V	500V	500V	2A	10A	1Ω-10MΩ	1Ω-22MΩ	< 50mΩ

Note: ① MWV=Max. Working Voltage. ② MOV=Max. Overload Voltage. ③ DWV=Dielectric Withstanding Voltage

④ MRC=Max. Rated Current ⑤ MOC=Max. Overload Current

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POWER DERATING CURVE



Note: Operating temperature range is from -55℃ to +155℃

RATED VOLTAGE

Resistors should have a Rated Voltage DC or AC corresponding to Rated Power which can be calculated by formula as below.

The Rated Voltage of certain resistance value should be the calculated result or Max. Working Voltage of product series whichever less.

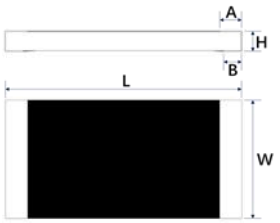
Formula:

$$E = \sqrt{P \times R}$$

E=Rated voltage(V)
P=Rated power(W)
R=Nominal resistance(Ω)

DIMENSIONS

Unit: mm

Figure	Type	L	W	H	A	B
	TL0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
	TL0402	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
	TL0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
	TL0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20
	TL1206	3.10±0.15	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20
	TL1210	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
	TL2010	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
	TL2512	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

RELIABILITY

Item	Test Method	Acceptable criterion
Temperature Coefficient of Resistance (T.C.R.)	$TCR(PPM/℃)=\frac{(R_2-R_1)}{R_1\times(T_2-T_1)}\times10^6$ R_1=Value in room temperature R_2=Value in test temperature -55℃ or +125℃ T_1=Room temperature T_2=Test temperature -55℃ or +125℃ Reference: IEC 60115-1 6.2	TL0201: 1Ω≤R≤10Ω: -100~+350PPM/℃ >10Ω: ±200PPM/℃ TL0402~2512: 1Ω≤R≤10Ω: ±200PPM/℃ >10Ω: ±100PPM/℃
Insulation Resistance	Using the parallel clamp method: 100±15V_{DC} voltage is applied between the electrode and the substrate within 60 seconds. Test the insulation resistance between the terminal and the back of the part. Reference: IEC 60115-1 12.1.3.5	⩾ 10^9Ω

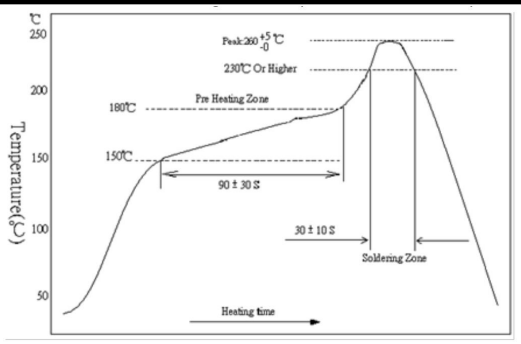
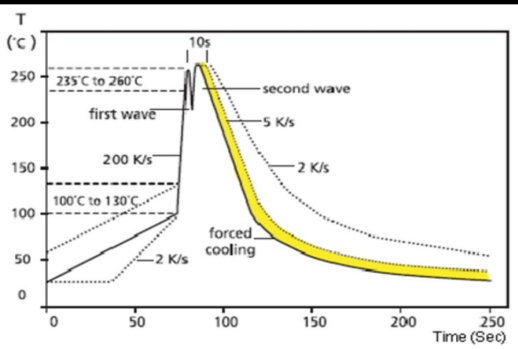
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Item	Test Method	Acceptable criterion
Dielectric Withstanding Voltage	An alternating current with an effective value of the maximum overload voltage is applied between the electrode and the substrate at a rate of approximately 100V/sec. Pressure, maintain 60± 5 sec. The test voltage reference to the DWV in characteristics. Reference: IEC 60115-1 12.2.4	Test to confirm if the presence of current or arc breakdown by ⩾10uA
Short Time Over Load	Apply 2.5 times of rated voltage or maximum overload voltage (whichever is the smallest) for 5 seconds Reference: IEC 60115-1 8.1.4.2	1% series: △R/R=±1.0% 5% series: △R/R=±2.0%
Intermittent Overload	Put it in the thermostat, apply 2.5 times of rated voltage, 1 second ON, 25 seconds OFF, 10000^{+400}_{-0} cycles, take it out and stand for 60 minutes, then measure the change rate of resistance value. Reference: IEC 60115-1 8.4.4	△R/R=±5.0%
Resistance to Solvent	Immerse in isopropanol solvent at room temperature (23±5℃) for 5min, wipe 10 times with a hard toothbrush, repeat 3 times, take out and blow dry for examination Reference: IEC 60115-1 11.3.2 method1	No obvious damage, peeling, swelling phenomenon
Solderability	Pretreatment: dry heat 155℃, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs. Test method: 1. Dip the resistance in a tin furnace at 245±3℃ for 3 seconds, then take it out and observe the solder area under a microscope; 2. Reflow soldering test, Peak Temperature: 235℃, T=40±5 sec. Reference: IEC 60115-1 11.1.4.3	1. Solder coverage over 95% 2. No welding refusal phenomenon, side soldering height is greater than 1/2 of the height
Leaching	Pretreatment: dry heat 155℃, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs. dip in a tin furnace at 260^{+5}_{-0}℃ for 30^{+1}_{-0} seconds, remove and wash. Observe the area of solder under a microscope Reference: IEC-60068-2-58	No electrode is eroded to expose the substrate phenomenon
Resistance to Soldering Heat	The tested resistor be immersed into molten solder of 260^{+5}_{-0}℃ for 10 seconds. Then the resistor is left in the room for 1 hr., then measure the change rate of resistance value Reference: IEC 60115-1 11.2.4.3	△R/R=±1.0%
Thermal Shock	High and low temperature test is carried out according to the upper and lower limits of the application temperature of the parts, the residence time of the upper and lower limits of the temperature is 30min, and the temperature conversion time is less than 30s, lasting 500 cycles Reference: IEC 60115-1 10.1.4	△R/R=±1.0%
Solder Joint Endurance Test	The SMD resistance was welded to the test board and bent with the standard pressure block. After standing for 60 sec. under the corresponding deformation condition, the change rate of resistance value of the part was tested. Size: 0402, 0603, 0805 | 0201, 1206, 1210 | 2010, 2512 Depth: 5mm | 3mm | 2mm Reference: IEC 60115-1 9.8.4	△R/R=±1.0%
Resistance to Dry Heat	Put it in an oven at 155±5℃ for 1000^{+48}_{-0}hrs., take it out and let it stand for more than 1hr., then measure the change rate of resistance value Reference: IEC 60115-1 7.3	1% series: △R/R=±1.0% 5% series: △R/R=±3.0%
Loading Life in Moisture	Place it in a constant temperature and humidity box with 40±2℃ and 90~95%RH and apply the rated voltage with 90 minutes ON and 30 minutes OFF, 1000 hrs. Take it out and stand for 60 minutes, and then measure the change rate Reference: IEC 60115-1 10.4	1% series: △R/R=±1.0% 5% series: △R/R=±3.0%
Load Life	Put in an oven at 70±2℃, apply rated voltage, 90 min ON, 30 min OFF, 1000 hrs., take out and stand for more than 60 min, then measure the resistance change rate. Reference: IEC 60115-1 7.1	1% series: △R/R=±1.0% 5% series: △R/R=±3.0%
Low temperature load test	-55℃, unpowered, 1 hr.: Rated voltage/current for 45 minutes, then unpowered within 15 minutes, return to room temperature, take out and stand for 24 hours, then measure the change rate of resistance value. Reference: IEC 60115-1 10.2.4	1% series: △R/R=±1.0% 5% series: △R/R=±2.0%
Shear force test	Weld the part to the PCB. Apply the corresponding test stress from the side of the part with the test terminal for 10s. Check the appearance of the welded end of the part under the stress condition Size: 0201 | 0402, 0603 | 0805 | 1206, 1210 | 2010, 2512 Test force: 2N | 5N | 9N | 25N | 45N Reference: IEC 60115-1 9.7	Without obvious damage.

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SOLDERING TEMPERATURE

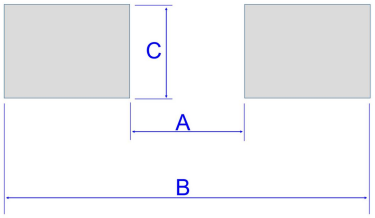
- Recommendation only. Please adjust it according to the actual application

Lead-free IR Reflow Soldering Profile	Lead-free Double-Wave Soldering Profile
	
Note: • The Max. Temp. is 260^{+5}_{0}℃ within 10 sec • Reference: J-STD-020D	Note: • Suit for ⩾ 0603 size • Manual soldering in 350±10℃ within 3 sec.

SOLDERING PAD

Resistance value would be lower than nominal value because of joint with soldering material, so designing circuit should adjust the pad size

Unit: mm

Figure	Type	A	B	C
	TL0201	0.3	1.0	0.4
	TL0402	0.5	1.5	0.6
	TL0603	0.8	2.1	0.9
	TL0805	1.2	3.0	1.3
	TL1206	2.2	4.2	1.6
	TL1210	2.2	4.2	2.8
	TL2010	3.5	6.1	2.8
	TL2512	3.8	8.0	3.5

WORKING ENVIRONMENT

If user intends to use products in special environments or states (including but not limited to the following), it is necessary to approve special characteristics and reliability for the following or other application environments.

A. High temperature, high moisture.
B. Near the sea, or corrosive gas, such as Cl_2, H_2S, NH_3, SO_2 and NO_2, etc.
C. Unverified liquids, such as water, oil, chemical or organic solvent.
D. Unverified resin or paint to cover products.
E. Products should be washed with water soluble cleaner even if non cleaning flux.

STORAGE / CARRY CONDITIONS

A. Temperature: 25±5℃
B. Humidity: 60±15%RH
C. Storage life: 0201 size: 1 year; ⩾0402 size: 2 years. FIFO.
D. Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall or squeeze the box, otherwise the product electrode or body may be damaged.

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VERSION HISTORY

Version	Date	Change Item(s)	Description
A	2023/02/08	-	First version
B	2025/04/08	Legal Disclaimer	Revise the entire text
C	2025/04/25	Feature	RoHS

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